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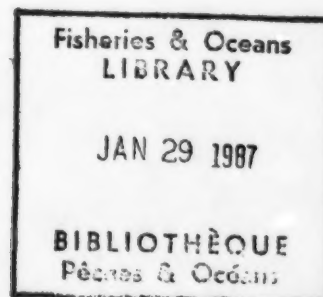
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ON THE EMBRYONIC AND POSTEMBRYONIC GROWTH AND SEXUAL MATURITY OF
OKHOTSK RINGED SEAL

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/1228

The ringed seal of the Sea of Okhotsk or akiba is the main species of the seal industry in the Far East, comprising 65% of the total seal catch. In spite of its great importance to the industry, the study of its biology has been limited. Most of the studies (Barabash-Nikiforov, 1935; Dorofeev, 1935, 1941; Lun', 1935; Nikulin, 1937; Naumov, 1941; Naumov and Smirnov, 1935; Pikharev, 1941; Freiman, 1935a, 1935b; Tikhomirov, 1961) have in varying degrees of detail characterized mainly the distribution of ringed seal. The exception is the study of M.M. Slep'tsov (1943), which covers certain questions concerning the biology of the reproduction of Far-Eastern pinnipeds, including ringed seal.

The question of the relationship between the rate of growth and the age of ringed seal has not been examined in the literature, and there are only isolated references to its minimal and maximal sizes (a body length of 87-116 cm - Barabash-Nikiforov, 1935; 50-135 cm - Naumov, 1941; 72-150 cm - Freiman, 1935a) and to its average size (117 cm for males and 108 cm for females - (Pikharev (1941). The differences in the body length of ringed seal are apparently due to small numbers

of seal being measured from different regions and to researchers not taking into account the age of the animals measured, since at that time methods for accurately determining the age of seal had not yet been developed.

This also affected the determination of the times of sexual maturation. For example, M.M. Sleptsov's data (1943) show that male and female ringed seal begin to mature at 2 years of age, and mating takes place in the second half of July through August. Pregnancy lasts 8 months. However, female ringed seal inhabiting the Canadian north mature mainly at 6-7 years, and the males - at 7-8 years (McLaren, 1958; Mansfield, 1963). The pregnancy of ringed seal inhabiting the waters of the Canadian north, with a latent period of 3.5 months, according to McLaren's data (1958), is approximately 11 months, i.e. 3 months longer than indicated by M.M. Sleptsov for the ringed seal of the Sea of Okhotsk.

Table 1

Monthly distribution					
Month	Number of specimens including				
	total	1960		1961	
		♀♀	♂♂	♀♀	♂♂
February	57	—	—	27	30
March	160	—	—	78	82
April	220	5	8	103	104
May	223	19	20	91	93
June	184	21	24	70	69
November	100	—	—	48	52
December	17	—	—	11	6
Total	961	45	52	428	436

Thus, the limited study of the rate of growth and of the sexual maturation of the Okhotsk ringed seal on the one hand, and the development of new methods of determining the age of seal in general and ringed seal in particular (Laws, 1952; Sheffer, 1950; McLaren, 1958; and others), on the other hand, compel us to consider these questions again.

MATERIAL AND METHOD

The material collected by the author at seal hunts in 1960 and 1961 forms the basis of this study. During this time, more than 960 ringed seal, caught in the northern part of the Sea of Okhotsk (primarily in the region of Tauyskaya Bay), were measured and weighed. The measurement of the body length was conducted in two ways: from the tip of the nose to the end of the tail, along the curvature of

the body and along a straight line (a projection). In addition, 64 embryos were measured and weighed in different periods of development. The distribution of the data, based on time, is given in Table 1.

In ringed seal, as in other seal, the weight of the body decreases considerably during moulting. Therefore, in determining the changes in body weight with age, we took into account only the weight of those animals which were caught /1229 prior to the moulting period - in February, March and April, or after the foraging period - in November and December. A total number of 554 animals were weighed for the age groups.

The onset of sexual maturity was determined by analyzing the sex organs. In the males, the presence or absence of mature sperm in the epididymis was noted (sperm smears were examined under a microscope), as well as the increase in the size and weight of the testes. In the females, pregnancy was taken to be the main characteristic of the onset of maturity; i.e. the presence of an embryo, the presence of milk in the mammary glands, hyperemia of the cornua of the uterus, their folding and enlargement. In addition, a microscopic analysis was made of ovary cross-sections - the presence of mature follicles, corpora lutea recently passed, and the new onset of pregnancy was determined. We used the rate of growth as the criterion for determining the sexual maturity of males and females,

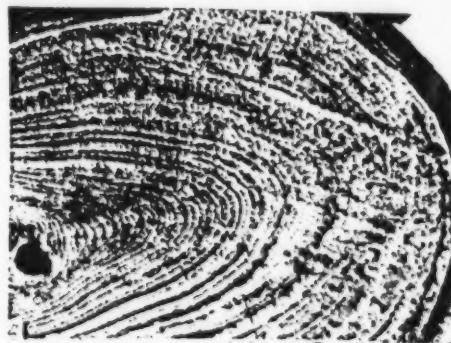


Fig. 1. Cross-sections of the teeth of ringed seal
A - at 28 years of age, b - at 15 years of age

especially their productive maturity (participation in reproduction).

It was assumed that a slowing down in growth is a sign of the onset of the period of sexual maturity. The age was determined for all of the animals (961 individuals). This was done by two methods: on the basis of the cornual case on the claws (Plekhanov, 1933; Chapskii, 1952), and the lamination of the dentin and cement of the teeth (Sheffer, 1950; Laws, 1952; McLaren, 1958; Rasmussen, 1957). Without going into a detailed characterization of the advantages of a particular method, we shall note that age is more accurately determined by the lamination of dentin and cement in the teeth (Fig. 1). On the basis of the cornual case, the age of ringed seal can only be accurately determined to the age of 7-8 years, and in some individuals to 12 years, but extremely rarely to 13 years, since the claws wear out at this age. On the basis of the lamination of the dentin and cement of the teeth, we determined the age of ringed seal to 28-30 years (Fig. 1a). Determining the age on the basis of the teeth consists of counting the annual rings of dense and porous dentin in a cross-section or microscopic section of the teeth (canini). It should be noted that the age is best determined from cross-sections of decalcified teeth rather than from microsections and polished sections. The fact of the matter is that it is very difficult to determine the age of old animals from microsections both in transmitted and reflected light and from polished sections because of the compact lamination of the rings of dental dentin and cement at this age, and therefore we cannot exclude the possibility of an inaccurate diagnosis of the age of animals older than 10-12 years. But on decalcified cross-sections of teeth in transmitted light, the rings in both the dentin and cement stand out more clearly, and they can be counted at any age for almost all seal. The method of preparing the cross-sections is fairly simple. A tooth or group of teeth are placed in a 10-12% solution of nitric acid for approximately 1 day or slightly longer, as a result of which the teeth become soft, and it is easy to prepare cross-sections/with a razor. The cross-sections of the teeth of old animals with a large number of rings in the dentin and cement

are best examined in a drop of water or pure vegetable oil. One of the advantages of determining the age from cross-sections of decalcified teeth is that this method is not time-consuming and enables large groups of teeth to be processed rapidly in a short period of time.

EMBRYONIC AND POSTEMBRYONIC GROWTH

The development of the embryo at the gastrula stage in ringed seal is /1230 observed in the middle or the end of July; in September the embryo reaches 5 cm in length, and in October - 10 cm (Sleptsov, 1953). The subsequent growth of the embryos of ringed seal is given in Table 2.

Table 2

Size of embryos of ringed seal according to month

Date	Sex	Number of specimens	Length, cm		Weight, g	
			lim	Mo	lim	Mo
15-30.XI	♂♂	9	14-31	26.3	160-875	650
	♀♀	7	20-33	26.7	360-1000	750
Total		16	—	26.5	—	700
I-15.III	♂♂	14	52-63	57	2700-4000	3100
	♀♀	11	48-62	56	2000-3800	2900
Total		25	—	57	—	3000
15-31.III	♂♂	9	54-62	57	2900-4000	3300
	♀♀	24	53-61	57	2700-4000	3200
Total		23	—	57	—	3250

The following conclusions can be drawn from the data presented. In the first 2.5 months after the latent period (see above) the embryo grows by 5 cm, or 8.3% of the average length at birth; in the next 2 months it grows by 21.5 cm, or 37%; and at 3.5 months prior to birth it grows by slightly over 30 cm or 54.7%. It is noted that the length and weight of the embryos scarcely change in March. This provides a basis for assuming that the embryonic development of the ringed seal ends in March, and pupping begins. Ringed seal pups in the "green" stage (the earliest pup stage) with yellowish-white hair, were encountered primarily in the latter half of March and the first half of April. In size and weight, the green-coats (4 specimens) were 57-65 cm and 3.5-4 kg, and the white-coats (7 specimens) - 58-66 cm and 3.7-4.7 kg. The average size and weight of all of the investigated recently born pups (evidently

2-8 days after birth) were 62 cm and 4 kg. When it is considered that in March the embryos, on average, do not exceed 57 cm in size, then obviously the average size of pups that have just been born is not greater than 58-59 cm (57-65). In the latter half of May through June, pups (17 specimens examined) exclusively in the gray-coat stage (pups that had changed the embryonic hair) were 64-72 cm in size, averaging 67 cm, and they weighed 6-9 kg, averaging 7.5 kg. Seven months after birth, in November, the underyearlings were 72-84 cm in size (averaging 78 cm) and weighed 10-14 kg (averaging 12 kg). The above body measurements of the pups were taken from the tip of the snout to the end of the tail, following the contours of the body.

The data on the length and body weight of pups for the given year of birth show that pup weight increases more rapidly initially. After 1.5-2 months, length and weight increase uniformly. The rapid increase in the weight of the pups after birth is obviously due to the highly nutritious properties of the milk of the females. Thus, for example, S.E. Kleinenberg (1956), referring to a number of researchers, indicates that the fat content of milk in marine mammals, including seal, reaches 48-50%. The lactation period in ringed seal is apparently approximately 1.5 months. An examination of the mammary glands shows that they contain milk from March to mid-May. During this time, we did not observe any food except milk in the digestive tract of the pups.

When the pups change over to independent feeding, they grow at a much slower rate than during the lactation period. The main food consumed by pups, judging by the dissection of the stomachs in November, consists of planktonic crustaceans (Euphausiacea). /1231

The data on the growth of ringed seal in the post-embryonic period are given in Table 3. From these data it can be seen that growth in females is most rapid to the age of 5 and in males - to the age of 6, inclusively. The rate of body growth in length slows down in females at 6-7 years of age and in males at 7-8 years,

Table 3

Size and weight of ringed seal

Age in years	Sex	Number of specimens	Body length, cm		Number of specimens	Weight, g	
			lim	Mo		lim	Mo
1	♂♂	40	78-92	85	21	10-16	14
	♀♀	47	77-90	83	11	10-18	13,5
	♂♂ ♀♀	87	—	84	32	—	14
2	♂♂	44	83-100	93	44	14-22	19
	♀♀	40	82-97	90	16	16-24	20
	♂♂ ♀♀	84	—	92	60	—	19
3	♂♂	62	91-105	98	48	20-26	24
	♀♀	46	91-106	97	16	14-28	23
	♂♂ ♀♀	108	—	98	64	—	24
4	♂♂	43	95-110	102	30	22-32	27
	♀♀	41	95-110	101	37	22-32	27
	♂♂ ♀♀	84	—	102	67	—	27
5	♂♂	41	101-115	107	26	24-34	29
	♀♀	32	99-113	105	24	26-34	30
	♂♂ ♀♀	73	—	106	50	—	29,5
6	♂♂	32	105-120	112	28	26-40	32
	♀♀	28	103-116	109	16	26-38	33
	♂♂ ♀♀	60	—	110	44	—	32
7	♂♂	34	105-125	113	33	28-42	33
	♀♀	31	104-122	112	12	30-46	36
	♂♂ ♀♀	65	—	113	45	—	34,5
8	♂♂	26	107-127	116	20	28-48	36,5
	♀♀	33	108-125	114	14	30-46	38,5
	♂♂ ♀♀	59	—	115	34	—	37,5
9	♂♂	30	112-137	119	23	32-48	39
	♀♀	33	109-127	115	9	34-46	40
	♂♂ ♀♀	63	—	117	32	—	39,5
10	♂♂	28	111-136	120	22	31-50	39
	♀♀	31	110-129	117	8	32-48	41
	♂♂ ♀♀	59	—	119	30	—	40
11	♂♂	24	111-133	120	17	34-55	40
	♀♀	31	110-138	117	5	36-42	38
	♂♂ ♀♀	55	—	119	22	—	39
12	♂♂	28	114-132	122	17	34-46	40
	♀♀	25	111-128	119	9	36-52	44
	♂♂ ♀♀	53	—	121	26	—	42
13	♂♂	16	113-137	122	8	34-46	39
	♀♀	15	114-129	120	4	40-46	44
	♂♂ ♀♀	40	116-139	124	33	36-52	43
14-30	♂♂	30	114-133	122	13	39-50	44
	♀♀	70	—	123	46	—	43

but their weight increases progressively. After 9-11 years, only a slow increase in length is observed in females and males, and the weight remains virtually the same. On the whole, the increase in body length in the females lags somewhat behind that of the males. The greater weight of the adult females is explained by the fact that most of them were pregnant when they were weighed. Evidently, the weight is the same for males and non-pregnant females of the same age, at least to five years of age, inclusive.

The body length of ringed seal varies greatly, particularly in the post-embryonic period. At the same time, in both the males and females, the body length of representatives of each age group differs greatly and varies within the limits of 1/232 the average values of the body length of the previous and next age groups (Fig. 2). With the onset of the period of sexual maturation, this pattern is no longer observed because of the slowing down of the animal's growth. After the period of sexual maturation, it appears again, but less distinctly and with larger age intervals. If we examine the variation in body length by age groups, using the absolute values for body length in plotting the graph instead of the size classes, as in Fig. 2, then the pattern of variation given above also appears. At the same time, however, the body length of some individuals (5-7%) lies outside the mode of the previous and next age groups.

The embryo grows to an average of approximately 59 cm, which is slightly more than 50% of the average length of the sexually mature animals. But, in terms of weight, the pups at birth reach an average of only 10% of the average weight of the sexually mature individuals. The body length of the pups increases by only 26% in the first year of life, whereas their weight increases more than three-fold. In the second year, the increment in length is slightly more than 10%, and in weight - approximately 50%. A higher rate of increase in body weight compared to the rate in linear growth is observed to the age of 6-7 years. Subsequently, the body length and weight increase at considerably slower rates to the age of 12-13 years, at which, apparently, the physical maturity of ringed seals begins.

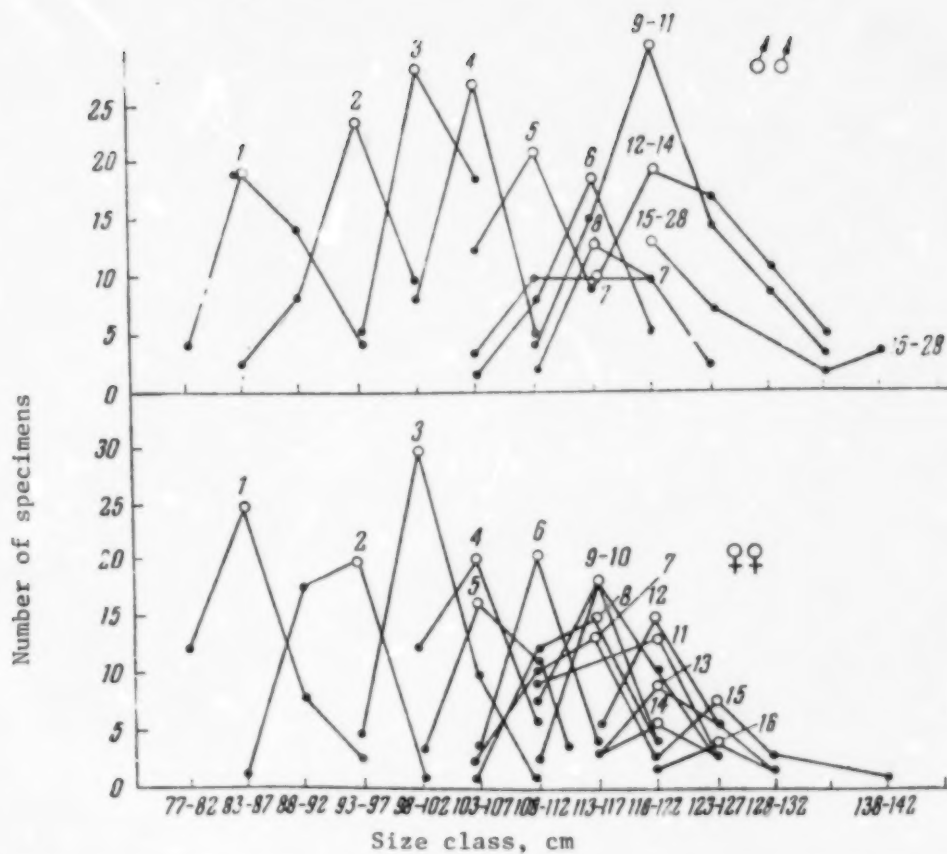


Fig. 2. The nature of the variation in body length by age group. The numbers above the peaks of the curves designate the age in years

The period of sexual maturation for males and females begins at 5-6 years of age. The rate of growth of the females slows down after 5 years. By /1233 6-7 years, they reach an average length of 109-112 cm, which is 87-90% of the average length of sexually mature individuals, and a weight of 32.5-36 kg, or 82-90% of the average weight of sexually mature animals. For marine mammals, it has been established that sexually maturity in females begins when they reach 80-87% of the average body length (Laws, 1956).

The youngest pregnant females in our samples were 6-year-olds (out of 29 6-year-olds, 9, or 31%, were pregnant). Of the 27 7-year-olds, 24, or 88%, were pregnant. In subsequent age groups, up to 14 years, inclusive, the relative number of pregnant females varied from 91 to 96% (176 specimens were examined). Only in the 15-17-year-old females (17 specimens) did the number of pregnant females decrease to 67 and 50%, respectively. The 18-20 year-old females (3 specimens) were not pregnant. A microscopic analysis of cross-sections of ovaries, collected from March to June, showed that the corpora lutea of pregnancy are only encountered in females 6-7 years old and older. Macroscopically visible mature follicles (with a diameter of of the 16-20 mm) were observed in 11% (3 out of 27)/4-year-olds, in 53% (9 out of 17) of the 5-year-olds, and in almost all older individuals. The minimum size of females that were pregnant or had signs of pregnancy, was 103 cm, and of females with mature follicles - 100 cm. The lowest weight in the former was 31 kg and in the latter, 29 kg. In general, it is observed that sexual maturity in females is related to both the increase in body length and the increase in weight. However, productive maturity (participation in reproduction) in the vast majority of females obviously depends not so much on body length as on the weight of the body. Actually, in our material, out of the 183 females that participated in reproduction, only 7 (4.3%) weighed under 34 kg. The remainder weighed 34 kg and sometimes more. Of the 107 females that were 103-104 cm long, 64, or 60%, were pregnant.

In both the males and females, a greater relationship is observed between sexual maturity and weight than between sexual maturity and body length. One

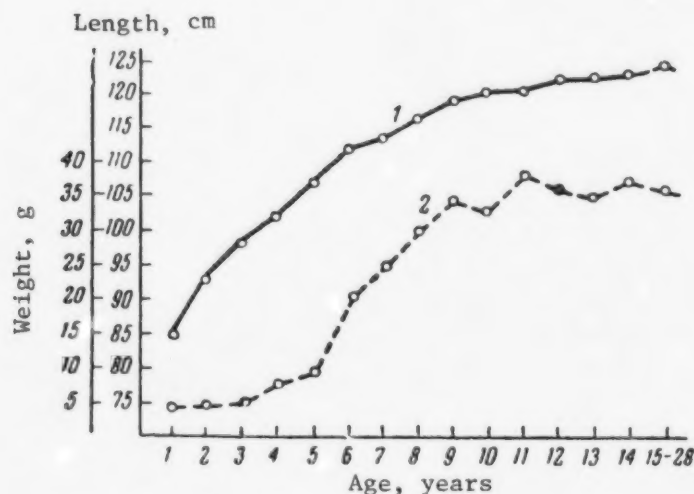


Fig. 3. The change in the body length and weight of the testes of male ringed seals with age

The curves are based on averages: 1 - body length, 2 - weight of testes

is easily convinced of this. The rate of growth slows down in the males at 6 years of age (Table 3, Fig. 3). However, the weight continues to increase considerably until 8 years, inclusive, i.e. until the age after which all of the males are sexually mature. After 8 years, the weight increases negligibly. This rate of growth indicates that sexual maturity in male ringed seal occurs in the period from 6 to 8 years. This is confirmed by other more important criteria of sexual maturity in males. A microscopic examination of smears of sperm taken from the epididymis in March-June showed that no sperm was present in males up to 5 years inclusive; mature sperm was found in 16% of the 6-year-olds (3 out of 19), in 66% /1234 (18 out of 27) of the 7-year-olds, and in almost all of the older males. It should be noted that in the latter half of May the quantity of sperm in the epididymis of the testes was considerably less, and it was more liquid than in April. There was almost no sperm in the males in June. A sharp increase in the size of the testes, which is also an indicator of sexual maturation, occurs at six years of age (Fig. 3). Thus, some males (16%) reach sexual maturity at the age of 6 years; after 7-8 years, all males are sexually mature.

The presence of mature follicles in the ovaries and mature sperm in the testes was observed from March to May. However, mature follicles were found most often in ovaries in April and the first half of May. At the same time, an abundance of mature sperm was observed in the epididymis. In the latter half of April and in May, ruptured follicles and corpora lutea of ovulation or the onset of pregnancy were observed in the ovaries of the uterine horns of ringed seal that were not pregnant the previous year. On this basis, it may be concluded that most ringed seal mate in the latter half of April and the first half of May. If the embryo in the females begins to develop in the latter half of July (Sleptsov, 1943), then it can be assumed that in this sub-species of ringed seal, as in other pinnipeds (McLaren, 1958; Popov, 1960), the implantation of the blastocyst is delayed by 2.5-3 months.

REFERENCES

1. Barabash-Nikiforov, I.I., 1935. Pinnipeds of the Commander Islands. Tr. Vses. n.-i. in-ta morsk. rybn. kh-va i okeanogr., Vol. 3.
2. Dorofeev, S.V., 1935. Contributions to the commercial biology of pinnipeds in the spring-ice period in the Tatar Strait, Tr. Vses. n.-i. in-ta morsk. rybn. kh-va i okeanogr., Vol. 3.
- 1941. Aerial search for seal in the Sea of Okhotsk, Izv. Tikhookeansk. n.i. in-ta morsk. rybn. kh-va i okeanogr., Vol. 20.
3. Kleinenberg, S.A., 1956. Mammals of the Black Sea and the Sea of Azov, Izd.-vo AN SSSR, M.
4. Lun', S.S., 1935. Pinnipeds of western Kamchatka (Tagil region), Tr. Vses. n.-i. in-ta morsk. rybn. kh-va i okeanogr., Vol. 3.
5. Naumov, S.P., 1941. Pinnipeds of the Sea of Okhotsk, Uch. zap. Mosk. ped. in-ta, Vol. 24, No. 2.
6. Naumov, S.P. and Smirnov, N.A., 1935. Material on the systematics and geographic distribution of Phocidae of the northern part of the Pacific Ocean, Tr. Vses. n.-i. in-ta morsk. rybn. kh-va i okeanogr., Vol. 3.

7. Nikulin, P.G., 1937. Observations of Pinnipeds of the Sea of Okhotsk and the Sea of Japan, *Izv. Tikhookeansk. n.-i. in-ta morsk. rybn. kh-va i okeanogr.*, Vol. 10.
8. Pikharev, G.A., 1941. Seal of the southwestern part of the Sea of Okhotsk, *Izv. Tikhookeansk. n.-i. in-ta morsk. rybn. kh-va i okeanogr.*, Vol. 20.
9. Plekhanov, P., 1933. Determining the age of seal, *Byul. n.-i. in-ta zool.*, Medgiz, M.
10. Popov, L.A., 1960. On the advent of sexual maturity in hooded seal, *Tr. Polyarn. n.-i. in-ta morsk. rybn. kh-va i okeanogr.*, No. XII.
11. Sleptsov, M.M., 1943. On the biology of the distribution of the Pinnipeds of the Far East, *Zool. kh.*, Vol. XII, No. 2.
12. Tikhomirov, E.A., 1961. The distribution and migration of the seal of the Far East, *Tr. soveshch. po ekologii i promyslu morskikh mlekopitayushchykh*, *Izd-vo AN SSSR*, No. 12.
13. Freiman, S.Yu., 1935. The distribution of Pinnipeds in the seas of the Far East, *Tr. Vses. n.-i. in-ta morsk. rybn. kh-va i okeanogr.*, Vol. 3.
 - 1935a. The commercial characteristics of the northern part of the Sea of Okhotsk, *ibid.*
 - 1935b. Contributions to the commercial biology of the seal of the Far East, *ibid.*
14. Chapskii, K.K., 1952. On a method for determining the age of mammals. The structure of the claws as an indicator of the age of Greenland seal, *Izv. estesvennonauchn. n.-i. in-ta im. P.F. Lesgafta*, Vol. 25.
- 15-19. English entries (see original bibliography).

ЛИТЕРАТУРА

- Барабаш-Никифоров Н. И., 1935. Ластоногие Командорских островов, Тр. Всес. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 3.
- Дорофеев С. В., 1935. Материалы к промысловой биологии ластоногих в весенний ледовый период в Татарском проливе, там же, т. 3.—1941. Воздушные разведки тюленей в Охотском море, Изв. Тихоокеанск. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 20.
- Клейнбергер С. А., 1956. Млекопитающие Черного и Азовского морей, Изд-во АН СССР, М.
- Лунь С. С., 1935. Ластоногие Западной Камчатки (Тагильский район). Тр. Всес. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 3.
- Наумов С. П., 1941. Ластоногие Охотского моря, Уч. зап. Моск. пед. ин-та, т. 24, вып. 2.
- Наумов С. П. и Смирнов Н. А., 1935. Материалы по систематике и географическому распределению Phocidae северной части Тихого океана, Тр. Всес. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 3.
- Никитин П. Г., 1937. Наблюдения над ластоногими Охотского и Японского морей, Изв. Тихоокеанск. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 10.
- Пихарев Г. А., 1941. Тюлени юго-западной части Охотского моря, Там же, т. 20.
- Плеханов П., 1933. Определение возраста тюленей, Бюл. н.-и. ин-та зоол., Медгиз, М.
- Попов Л. А., 1960. О наступлении половой зрелости у хохлатых, Тр. Полярн. н.-и. ин-та морск. рыбн. х-ва и океаногр., вып. XII.
- Слепцов М. М., 1943. О биологии размножения ластоногих Дальнего Востока, Зоол. ж., т. XII, вып. 2.
- Тихомиров Э. А., 1961. Распределение и миграции тюленей Дальнего Востока, Тр. совещ. по экологии и промыслу морских млекопитающих, Изд-во АН СССР, вып. 42.
- Фрейман С. Ю., 1935. Распределение ластоногих в морях Дальнего Востока, Тр. Всес. н.-и. ин-та морск. рыбн. х-ва и океаногр., т. 3.—1935а. Промысловая характеристика северной части Охотского моря, Там же.—1935б. Материалы к промысловой биологии тюленей Дальнего Востока, Там же.
- Чапский К. К., 1952. К методике определения возраста млекопитающих. Структура когтей как возрастной признак гренландского тюленя, Изв. естественнаучн. н.-и. ин-та им. П. Ф. Лесгафта, т. 25.
- Laws R. M., 1952. A New Method of Age Determination for Mammals Nature, 169.—1956. Growth and Sexual Maturity in Aquatic Mammals, Nature, No. 178.
- Mansfeld A. W., 1963. Seal of Arctic and Eastern Canada, Bull. Fish. res. Board Canada, No. 137.
- McLaren I. A., 1958. The Biology of the ringed Seal (*Phoca hispida*) in the Eastern Canadian Arctic, Bull. Fish. res. Board Canada, No. 118.
- Rasmussen B., 1957. Exploitation and Protection of East Greenland Seal Herds, Norwegian Whaling Gazetteer, 2.
- Sheffer V., 1950. Growth Layers on the Teeth of Pinnepedia as an Indication of Age, Science, 412.

ON THE EMBRYONIC AND POSTEMBRYONIC GROWTH
AND SEXUAL MATURATION IN *PHOCA HISPIDA*
OCHOTENSIS PALL.

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Summary

The study of 960 individuals of *Phoca hispida ochotensis* Pall. revealed that sexual maturity of males occurred at the age of 6–8 years, and of females — at the age of 5–7 years. The coupling took place immediately after the procreation — from the end of March to the 1st half of May (maximum — in the end of April and beginning of May). The length of new born individuals was 57–65 cm, the weight — 3.5–4.7 kg.

At the average weight of 7.5 kg and body length of 64–72 cm in the stage of sadler grey cubs begin to feed actively. The intense growth of body length lasts in females up to the age of 5 years and in males — up to the age of 6 years. The maximum body length in the studied individuals was 139 cm, and weight — 55 kg.